Knowledge Requirements, Gaps and Learning Practices in Smart Grid Adoption; an Exploratory Study in U. S. Electric Utility Industry

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The U.S. electric utility industry is facing a number of challenges today, including aging infrastructure, growing customer demand, CO_2 emissions, increased vulnerability to overloads, and outages. In response, utilities are investing in smart grid technologies, which apply IT to existing grid to enable a more observable, controllable, and automated power supply.

Yet, the adoption of smart grid technologies presents significant knowledge challenges to electric utilities. This study aims to advance the understanding of IT knowledge challenges in smart grid adoption by focusing on three research questions:

1) What knowledge requirements are critical for smart grid adoption?
2) What knowledge gaps are utilities facing with smart grid adoption? How do utilities vary in the level of knowledge gaps?
3) What learning practices do utilities take to overcome these knowledge gaps in smart grid adoption? How do utilities vary in the choice of these practices?

This research adopts a qualitative approach using data from 20 utility interviews and secondary information to address the above questions. The analysis indicates four broad areas of knowledge requirements and several knowledge gaps faced by utilities.

It confirms that utilities vary in the level of knowledge gaps, which depends on a mix of organizational and environmental factors including prior experience, level of advance in IT infrastructure, service territory characteristics, size, scope of integration, and support from external organizations.

The data further indicates several learning practices that are commonly adopted by utilities to overcome the knowledge gaps in smart grid adoption. It is also determined that utilities vary in the choices of these practices, and variances are jointly determined by knowledge relatedness, level of knowledge gaps, size, and top management attitude.

This study has both research and practical implications. It enriches both IT adoption and organizational learning literature in several ways. It also has valuable implications for utilities, regulators and other regulated industries and economies.